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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/808,559
Filing Date: March 25, 2004
Appellant(s): KAJI ET AL.

Gregory E. Montone
For Appellant

EXAMINER'S ANSWER

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This is in response to the appeal brief filed April 07, 2008 appealing from the Office action mailed February 15, 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is substantially correct.

Claims 8-10, 12-25 and 27-38 are pending in the application. Claims 8-10, 12-25 and 27-38 are finally rejected. Claims 1-7, 11, and 26 are cancelled.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct. An amendment after final was submitted on August 28, 2007 and has been entered. As a result of the amendment, claim 8 has been amended to provide the correct spelling for density. No new issues are raised by this change, which was caused by this amendment. Examiner maintained the final rejection in Advisory action mailed on September 20, 2007, and

indicated that the request for reconsideration was considered, but does not place the application in condition for allowance due to the outstanding rejections.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is generally correct.

The present invention is directed to a plasma processing apparatus for processing a sample having a diameter of 300 mm or more. The apparatus includes a vacuum processing chamber, a gas supplying unit, an upper electrode, a lower electrode, an outer chamber, an evacuation means, a high frequency electric power source, a bias electric power source, an electrode cover, a susceptive cover, and a discharge confining means. The outer chamber surrounds the vacuum processing chamber and is connected with an evacuation means. The high frequency electric power source supplies a high frequency energy for generating plasma between the upper and the lower electrode. The density of the plasma used to process the sample ranges between 5×10^{10} cm^{-3} to 5×10^{11} cm^{-3}. The bias electric power source is connected to the lower electrode to control the energy of ions in the plasma. The electrode cover is comprised of silicon and is provided on the outer surface of the upper electrode. The susceptive cover is comprised of silicon and is provided near a sample mounting surface of the lower electrode. The discharge confining means is comprised of SiC and separates the vacuum chamber from the outer chamber. In addition, the discharge confining means is used to increase the plasma density.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

The issues are if:

1. Claims 8, 13, 16, 19, 24, 25, 29, 33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lenz et al. (U.S. 5,534,751) in view of Ohmi (U.S. 5,272,417) and Lenz et al. (U.S. 5,569,356).

2. Claims 9-12, 14-15, 17-18, 20-23, 30, 34, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lenz et al. (U.S. 5,534,751) in view of Ohmi (U.S. 5,272,417) and Lenz et al. (U.S. 5,569,356) as applied to claims 8, 13, 16, 19, 24, and 25 above, and further in view of Steger et al. (U.S. 5,494,523) or Ogasawara et al. (J.P. 07-135200).

3. Claims 27, 28, 31, 32, 37, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lenz et al. (U.S. 5,534,751) in view of Ohmi (U.S. 5,272,417), Lenz et al. (U.S. 5,569,356), Steger et al. (U.S. 5,494,523) or Ogasawara et al. (J.P. 07-135200) as applied to claims 9-12, 14-15, 17-18, and 20-23 above, and further in view of Koshiishi et al. (U.S. 5,919,332) and Lenz et al. (U.S. 5,609,720).

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,534,751	LENZ et al	07-1996
5,272,417	OHMI	12-1993
5,569,356	LENZ et al	10-1996
5,494,523	STEGER et al.	02-1996
07-135200	OGASAWARA et al	05-1995
5,919,332	KOSHIISHI et al	07-1999
5,609,720	LENZ et al	03-1997

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 8, 13, 16, 19, 24, 25, 29, 33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lenz et al. (U.S. 5,534,751) in view of Ohmi (U.S. 5,272,417) and Lenz et al. (U.S. 5,569,356).

Referring to Figures 1 and 2, column 4, line 48-column 6, line 65, Lenz et al. discloses a plasma processing apparatus comprising: a vacuum processing chamber 17 for processing a sample, by using plasma, an outer chamber 11 surrounding the vacuum processing chamber 17 connected with an evacuation means (col. 4, lines 53-54, col. 5, lines 4-5) (Note. evacuation means 18 is structurally equivalent to the evacuation means of Lenz'751 since it exhausts the gas out of the processing region), a gas supplying unit for introducing into the vacuum processing chamber a processing gas (col. 5, lines 1-4); an upper electrode 14 and a lower electrode 13 for generating plasma therebetween and providing the vacuum processing chamber (col. 4, lines 60-

63); a discharge confining means 30 separating the vacuum processing chamber 17 from the outer chamber 11 and for increasing plasma density in the vacuum processing chamber (Fig. 1, col. 6, lines 8-29). (Note. In the instant case, applicant's discharge confining means 37 is structurally equivalent to the confinement ring 30 of Lenz'751 since it surrounds the plasma processing region, separates the vacuum chamber from the outer chamber, and confines the plasma to smaller region).

Lenz et al. fails to teach the electrode cover is made of silicon.

Referring to column 6, lines 33-43, Ohmi teaches an electrode cover 101 made of silicon. The electrode cover 101 prevents etching of the electrode 102. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide one of the electrodes of Lenz et al. with the an electrode cover cas taught by Ohmi in order to prevent etching of the electrode.

Lenz et al.'751 fails to teach the discharge confining means is made of SiC.

Referring to Figures 2 and 3, column 5, line 3-column 6, line 10, Lenz et al.'356 teaches a plasma processing apparatus which uses a discharge confining means 34 made of SiC since the material is stable in a plasma environment (col. 2, lines 25-29, col. 5, lines 13-16, 54-64). Additionally, the motivation for making the discharge confining means out of SiC is to provide an alternate material of construction that would limit the contamination caused by the interaction of plasma. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention for the discharge confining means of Lenz et al.'751 to be made of SiC as taught by Lenz et al.'356 since it is an alternate material of construction that would limit the contamination caused by the interaction of plasma.

Regarding the limitation of "fluorine-containing etching gas", the type of gas used in apparatus claims is considered intended use and therefore is of no significance in determining patentability. Expressions relating the apparatus to contents thereof during an intended operation are of no significance in determining patentability of the apparatus claim. Ex parte Thibault, 164 USPQ 666, 667 (Bd. App. 1969). Additionally, Ohmi teaches that a fluorine containing gas is conventionally used for etching a film (col. 6, lines 29-33). Thus, the apparatus of Lenz et al. in view of Ohmi is capable of providing a fluorine containing gas to the chamber.

Regarding the limitation of "an insulator film in the sample", this is considered intended use and therefore is of no significance in determining patentability. The inclusion of material or article worked upon by a structure being claimed does not impart patentability to the claims." In re Young, 75 F.2d 966, 25 USPQ 69 (CCPA 1935) (as restated in In re Otto, 312 F.2d 937, 136 USPQ 458, 459 (CCPA 1963). Moreover, the apparatus of Lenz et al. in view of Ohmi is capable of processing various types of films (Lenz et al., col. 6, lines 3-7, Ohmi, col. 12, lines 12-15) and thus is capable of processing an insulator film on the sample.

With respect to claims 13 and 24, the apparatus of Lenz et al. further includes that the discharge confining means 30 is ring-shaped (Fig. 2, and col. 5, lines 56-59).

With respect to claims 16 and 25, the apparatus of Lenz et al. further includes that the discharge confining means is provided with at least a gap for evacuating the processing gas from the vacuum chamber 17 to the outer chamber 12 (col. 6, lines 30-34).

With respect to claim 29, the apparatus of Lenz et al. further includes wherein the vacuum container includes an outer chamber 11, connected with an evacuation means, surrounding the vacuum processing chamber 17, and wherein the discharge confining means 30

is located to serve as means for separating the vacuum processing chamber 17 from the outer chamber 11 (Fig. 1).

With respect to claims 33 and 35, the apparatus of Lenz et al. further wherein the discharge confining means 30 is located for maintaining a uniform reaction in the vacuum processing chamber (col. 3, lines 23-38).

Claims 9-12, 14-15, 17-18, 20-23, 30, 34, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lenz et al. (U.S. 5,534,751) in view of Ohmi (U.S. 5,272,417) and Lenz et al. (U.S. 5,569,356) as applied to claims 8, 13, 16, 19, 24, and 25 above, and further in view of Steger et al. (U.S. 5,494,523) or Ogasawara et al. (J.P. 07-135200).

The teachings of Lenz et al. in view of Ohmi and Lenz et al.'356 have been discussed above.

Lenz et al. in view of Ohmi and Lenz et al.'356 fail to teach a susceptive cover comprised and made of silicon.

Referring to column 3, lines 39-42, and column 4, line 64-column 5, line 25 of Steger et al. and the abstract of, Steger et al. or Ogasawara et al. teaches it is conventionally known in the art to provide a sample mounting surface with a susceptive cover comprised of silicon in order to reduce particle trapping and to improve process uniformity. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the sample mounting surface of Lenz et al. in view of Ohmi and Lenz et al.'356 with the susceptive cover comprised and made of silicon as taught by Steger et al. or Ogasawara et al. since this would reduce particle trapping and improve process uniformity.

With respect to a high frequency electric power source, Lenz et al. further includes a high frequency electric power source 24 for generating plasma between upper 14 and lower 13 electrodes (Fig. 1, col. 5, lines 11-20)

With respect to a bias electric power source, Lenz et al. further includes a bias electric power source 23 to control the energy of ions in the plasma (Fig1., col. 5, lines 16-20, 34-38).

Claims 27, 28, 31, 32, 37, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lenz et al. (U.S. 5,534,751) in view of Ohmi (U.S. 5,272,417), Lenz et al. (U.S. 5,569,356), Steger et al. (U.S. 5,494,523) or Ogasawara et al. (J.P. 07-135200) as applied to claims 9-12, 14-15, 17-18, and 20-23 above, and further in view of Koshiishi et al. (U.S. 5,919,332) and Lenz et al. (U.S. 5,609,720).

The teachings of Lenz et al. in view of Ohmi, Lenz et al.'356, and (Steger et al., or Ogasawara et al.) have been discussed above.

It should be noted that the means for generating a plasma (power source 16, upper electrode 12, lower electrode15) is structurally equivalent to a high frequency electric power source 24 for generating plasma between upper 14 and lower 13 electrodes (Lenz'751, Fig. 1, col. 5, lines 11-20).

Lenz et al. in view of Ohmi, Lenz et al.'356, and (Steger et al., or Ogasawara et al.) fail to teach a plasma density of 5 x 10^{10} cm^{-3} to 5 x 10^{11} cm^{-3} between the upper electrode and lower electrode to etch a fine pattern on the sample having a diameter of 300 mm or more.

Referring to column 13, lines 14-17, Koshiishi et al. teach a plasma density of

5 x 10^{10} cm^{-3} to 5 x 10^{11} cm^{-3} between the upper electrode and lower electrode in order to perform fine etching with a high etching rate (col. 6, lines 10-20). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention for the plasma density of Lenz et al. in view of Ohmi, Lenz et al.'356, and (Steger et al., or Ogasawara et al.) to be 5 x 10^{10} cm^{-3} to 5 x 10^{11} cm^{-3} as taught by Koshiishi et al. in order to perform fine etching with a high etching rate.

Referring to column 2, lines 35-41, Lenz et al.'720 teach that it is conventionally known in the art to process a wafer having a diameter of 300 mm. Thus, it would have been obvious to scale up the apparatus including the table in Lenz et al.'751 in view of Ohmi, Lenz et al.'356, and (Steger et al., or Ogasawara et al.) in order to process a wafer having a diameter of 300 mm since it is conventionally known in the art to process wafers having a diameter of 300 mm. Additionally, according to In Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to scale up/down the apparatus including the table of in Lenz et al.'751 in view of Ohmi, Lenz et al.'356, and (Steger et al., or Ogasawara et al.) in order to process a sample with a diameter of 300 mm or more and additionally the motivation for optimizing the size of the table is to enable the table to hold the desired size of substrate.

(10) Response to Argument

A) Applicant has argued that the purpose of the Lenz'751 patent is to prevent the plasma from being generated outside of the confinement area, not to increase the plasma density within the confinement area, as required by the present means-plus-function claim language.

It should be noted that applicant has invoked 35 U.S.C. 112, sixth paragraph in the instant application. Thus, where means plus function language is used to define the characteristics of an apparatus, such language must be interpreted to read on only the structures or materials disclosed in the specification and "equivalents thereof" that correspond to the recited function. Furthermore, the claimed means plus function limitations are given their broadest reasonable interpretation consistent with all corresponding structures or materials described in the specification and their equivalents including the manner in which the claimed functions are performed. In the instant case, applicant's discharge confining means 37 is structurally equivalent to the confinement ring 30 of Lenz'751 since it surrounds the plasma processing region, separates the vacuum processing chamber 17 from the outer chamber 11, and confines the plasma to smaller region (Fig. 1, Lenz'751, col. 3, lines 15-38, col. 6, lines 39-65).

First of all, due to the inherent structure and function of the discharge confining means 30 of Lenz et al.'751, the plasma density is increased in the vacuum process chamber. Moreover, the function of the discharge confining means 30 of Lenz et al.'751 is to confine the plasma to a smaller region. Additionally, it should be noted that density is indirectly proportional to volume (D=M/V). Thus, when the discharge confining means is applied to the vacuum processing chamber, it reduces the plasma volume, and hence the density is increased. Therefore, the confinement ring 30 of Lenz'751 performs the function specified in the claim in substantially the

same manner as the function is performed by the discharged confining means 37 described in the applicant's specification. Therefore, the claimed structure of the discharge confining means is met by the confinement ring 30 of Lenz'751 and thus, the rejection of Lenz et al.'751 in view of Ohmi'417 and Lenz et al.'356 satisfies the claimed requirement of a discharge confinement means used to increase plasma density within a vacuum processing chamber.

B) Applicant has argued that Lenz'751 fails to teach the use of SiC for the discharge confining means.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Lenz'751 was simply applied for the structure of a discharge confining means 30 since it surrounds the plasma processing region, separates the vacuum chamber from the outer chamber, and for increasing the plasma density within a vacuum processing chamber and not the material of the discharging means. In the instant case, Lenz et al.'356 was applied to teach that it is conventionally known in the art for a discharging confining means to be comprised of SiC. Thus, the rejection of Lenz et al.'751 in view of Ohmi'417 and Lenz et al.'356 satisfies the claimed requirement.

C) Applicant has argued that the fact that Lenz'751 and Lenz'356 have the same lead inventor, and that the Lenz'356 was actually filed on May 19, 1995, before the July 10, 1995 filing date of the application leading to the '751 patent, thus clearly if Lenz had any intention of utilizing SiC as the discharge ring material in the '751 patent, this would have been disclosed as

an alternative. Therefore, the failure of Lenz to disclose SiC as an alternative in the '751 patent leads to a clear teaching away from the modification of the Lenz'751 structure in this manner.

However, it should be noted that the fact that Lenz'751 did not mention that a discharging confinement ring is comprised of SiC does not prove that it would not still be obvious to use SiC for the discharging confinement ring. Furthermore, the fact that Lenz'751 only refers to the use of dielectrics for the discharge confinement rings only proves that Lenz'751 fails to anticipate the claimed invention. Additionally, Lenz'356 proves and is evident that a discharge confinement ring can be comprised of a dielectric or alternatively of SiC and both materials of construction function to confine plasma (col. 5, lines 57-64). Thus, the motivation for making the discharge confining means out of SiC is to provide an alternate material of construction that would limit the contamination caused by the interaction of plasma. Finally, it must be emphasized that arguments of counsel alone cannot take the place of evidence in the record once an examiner has advanced a reasonable basis for questioning the disclosure (See In re Budnick, 537 F.2d at 538,190 USPQ at 424; In re Schulze, 346 F.2d 600, 145 USPQ 716 (CCPA 1965); In re Cole, 326 F.2d 769, 140 USPQ 230 (CCPA 1964)). Therefore, the rejection of Lenz'751 in view of Ohmi'417 and Lenz'356 satisfies the claimed requirement.

D) Applicant has argued that the combination adding Steger and Ogasawara would still not include a discharge confinement means comprised of SiC to increase plasma density within a vacuum processing chamber.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re*

Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Steger and Ogasawara were simply applied for the structure of a susceptive cover comprised and made of silicon. As stated above, Lenz et al.'356 was applied to teach that it is conventionally known in the art for a discharging confining means to be comprised of SiC. Lenz'751 was simply applied for the structure of a discharge confining means 30 since it surrounds the plasma processing region, separates the vacuum chamber from the outer chamber, and for increasing the plasma density within a vacuum processing chamber. Thus, the combinations of Lenz et al.'751 in view of Ohmi'417 and Lenz et al.'356 satisfies the claimed requirement of a discharge confinement means comprised of SiC to increase plasma density within a vacuum processing chamber.

E) Applicant has argued that the combination of the plasma density and the discharge confining means for increasing plasma density set forth in claim 28 is neither taught nor suggested by the combination relying on Koshiishi set forth in the rejection.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Koshiishi'332 was simply applied to teach that it is conventionally known in the art to use plasma density of 5×10^{10} cm^{-3} to 5×10^{11} cm^{-3} between the upper electrode and lower electrode in order to perform fine etching with a high etching rate. As stated above, Lenz'751 teaches the structure of a discharge confining means 30 used to increase plasma density within a vacuum processing chamber. Thus, the combinations of Lenz et al.'751 in view of Ohmi'417, Lenz et al.'356, (Steger'523 or

Ogasawara'200) and Koshiishi'332 satisfies the claimed requirement of a discharge confining means used to increase plasma density at the desired plasma density.

F) Applicant has argued that there is nothing in the Lenz'720 patent which suggests the particular design of a discharge confining means to achieve the sufficient pressure and uniform etching of such a large diameter water.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Lenz'720 was simply applied to teach that it is conventionally known in the art to process a wafer having a diameter of 300 mm. As stated above, Lenz'751 teaches the structure of a discharge confining means 30 used to achieve the sufficient pressure and uniform etching. Thus, the combinations of Lenz et al.'751 in view of Ohmi'417, Lenz et al.'356, (Steger'523 or Ogasawara'200) and Lenz'720 satisfies the claimed requirement of a discharge confining means to achieve the sufficient pressure and uniform etching of such a large diameter water.

G) Applicant has argued that although the Lenz'751 patent has been cited for teaching separation of a vacuum processing chamber from the an outer chamber, it is noted that this "separation" is by a ring structure which is very largely comprised of slots which will significantly reduce any effective separation of the vacuum processing chamber from the outer chamber.

It should be noted that claim 8 simply requires a discharging confining means 37 that separates the vacuum processing chamber 10 from the outer chamber. Similarly, as seen in

Figure 1, Lenz et al.'751 discloses a discharge confining means 30 separating the vacuum processing chamber 17 from the outer chamber 11. Since the claim broadly describes the structure of the discharge confining means and fails to describe specific characteristics (i.e. dimension of the slot (hole) or number of slots (holes)), then, the combination of Lenz et al.'751 in view of Ohmi'417, Lenz et al.'356, and Lenz'720 satisfies the claimed requirement.

H) Applicant has argued that absolutely nothing in this language from the Lenz'751 teaches or suggests the claimed feature of "the discharge confining means is located for maintaining a uniform reaction in the vacuum processing chamber."

However, it is well established in the art to achieve a uniform reaction since it's a desired property in plasma processing of substrates. For example, discharge confining means 73 of Koshiishi'332 restricts the plasma to the processing region and thus is used to perform fine and uniform processing of the substrate (Fig. 10, col. 18, line-28-col. 20, line 36, specifically, col. 18, lines 18-40 and col. 20, lines 9-25). Hence, the discharge confining means 30 of Lenz'751 works similarly by restricting the plasma to the processing region and thus will achieve similar results of a uniform reaction in the vacuum processing chamber. Therefore, the rejection of Lenz'751 in view of Ohmi'417 and Lenz'356 satisfies the claimed requirement.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

In summary, each of the rejected claims is obvious for the reasons argued at length above. It is respectfully stressed that Lenz et al.'751 discloses the structure of the discharge confining means and Lenz et al.'356 provides the motivation for the discharge confining means comprised of SiC and hence the combination satisfies the claimed requirement of the discharge confining means.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Michelle Crowell Assistant Examiner

/Michelle Crowell/

Examiner, Art Unit 1792

Conferees:

/Parviz Hassanzadeh/
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